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# Forest Health Protection

## Pacific Southwest Region



Date: August 27, 2001  
File Code: 3400

To: District Ranger, Big Valley Ranger District, Modoc National Forest

Subject: Follow-up evaluation of Douglas-fir tussock moth defoliated trees and life stage monitoring on the Big Valley Ranger District (Report No. NE01-04).

### Summary

Defoliation of white fir by Douglas fir tussock moth (DFTM) was detected by aerial survey in three areas on the Big Valley Ranger District, Modoc National Forest, in 1999. Forest Health Protection staff installed permanent plots (10 plots/5 trees per plot) within the areas to monitor the survivability of the defoliated white fir. Defoliated trees had 10-80% of the current year's foliage damaged by larval feeding. Trees were re-evaluated during the summer of 2000 and all were alive with no apparent decrease in growth or vigor. Increment cores will be taken in 2004 to evaluate the effects on radial growth, if any, caused by the single year loss of current needles.

In addition, life stage sampling (larvae and adults) conducted in 2000 confirmed that the population had declined to an endemic level. This was expected based on no egg masses being found during a November 1999 survey. The numbers of all life stages collected were well below the thresholds that are typically indicative of a new or continuing outbreak.

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## History and Background

A Douglas fir tussock moth (DFTM) outbreak was detected in mid-August of 1999 during the annual aerial survey flight of the Big Valley Ranger District, Modoc National Forest. The outbreak covered approximately 2,200 acres of National Forest and private land. As a result of this defoliation, subsequent sampling was conducted to assist with predicting the likelihood of the population level being high enough to cause defoliation the following year and to visually monitor the effects of the defoliation on individual trees (See FPM Report No. NE00-04 dated 4 February 2000 for details on DFTM biology, outbreak cycles and sampling methods).

The Douglas fir tussock moth, *Orgyia pseudotsugata* (Lepidoptera: Lymantriidae) is a native defoliator of true firs, *Abies* spp. and Douglas-fir, *Pseudotsuga menziesii* in the western United States. The primary host of the tussock moth in California is white fir, *Abies concolor*. High numbers of larva feeding can result in tree mortality, top kill and growth loss, (Wickman et al. 1981). Douglas-fir tussock moth populations periodically reach outbreak levels in California (Table 1). Outbreaks appear with little or no warning and last from one to four years. Most outbreaks are short lived (Wickman et al. 1981) and usually decline due to natural control factors a year or two after defoliation is first detected.

Table 1. The location, duration and size of major DFTM outbreaks in California since 1935.

| Years     | Location (County)  | Acres of Defoliation |
|-----------|--|----------------------|
| 1935-1937 | Mono   | 15,000 acres         |
| 1954-1956 | Calaveras, Tuolumne  | 11,000 acres         |
| 1963-1965 | Modoc, Plumas, Lassen, El Dorado   | 78,000 acres         |
| 1970-1972 | Amador, Calaveras, El Dorado, Fresno, Madera, Mariposa, Shasta, Tulare, Tuolumne | 100,000+ acres       |
| 1987-1989 | Lassen, Plumas, Sierra, Tehama   | 105,000 acres        |
| 1998      | Fresno, Tulare   | 44,000 acres         |
| 1999      | Modoc  | 2,200 acres          |

## Year 1999 - 2000 Monitoring Results

**Egg masses:** No tussock moth egg masses were collected during field sampling in November 1999 or in any of the 100 artificial shelters (Dalsten et al. 1992) established in the outbreak area.

**Adults:** Fall 1999 pheromone trap catches averaged 16.7 moths/trap/plot. Two plots averaged > 25 moths/trap, which is the threshold to warn of increasing DFTM population levels or in this case maintaining at an outbreak level. Follow-up larval monitoring was conducted in 2000 due to these elevated trap catches.

Fall 2000 pheromone trap catches averaged 1.3 moths/trap/plot.

**Larvae:** A total of 13 larvae were collected in June 2000 from the foliage of 600 trees sampled from within the outbreak areas. This is below the average of 20 larva/ per 0.64 sq. m. (1000 sq. in.) of foliage that denotes a population in an "outbreak" condition.

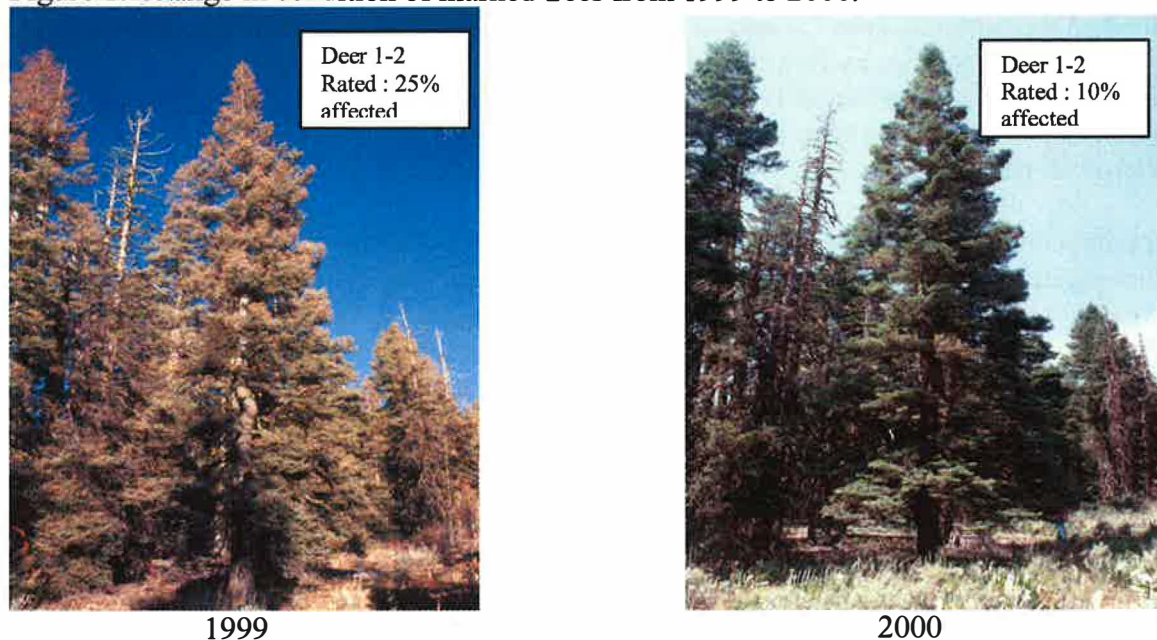
**Defoliation:** Forest Health Protection staff installed permanent plots in 1999 (10 plots/5 trees per plot) within the outbreak areas to monitor the survivability of the defoliated white fir. Defoliated trees had 10-80% of the current year's foliage damaged by larval feeding. Trees were re-evaluated during the summer of 2000 and all were alive with no apparent decrease in growth or vigor. Figure 1 contains photos of two marked trees that display differences in needle compliment between 1999 and 2000. These trees are representative of the observed changes in the remaining marked trees.

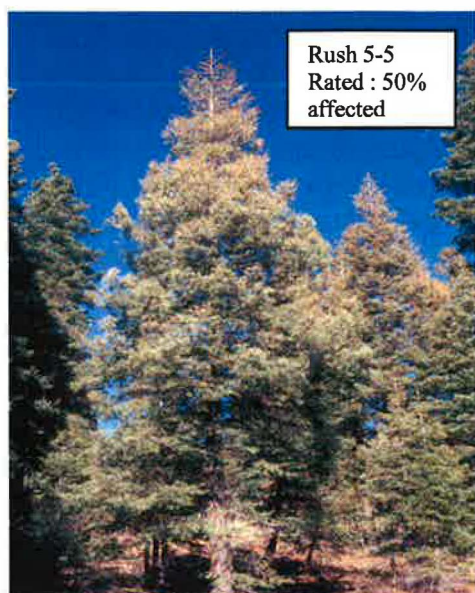
**Radial growth:** Increment cores will be taken in 2004 to observe the effects on radial growth, if any, caused by the single year loss of current needles.

### Discussion

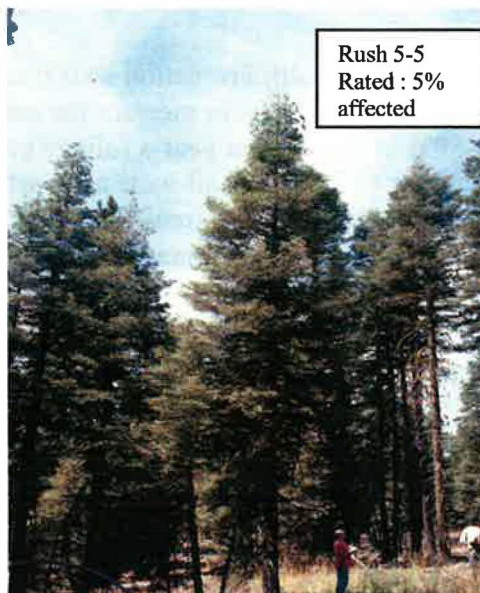
Based on the low numbers of all DFTM life stages monitored following the defoliation the 1999 outbreak was confined to a single season. Although there is no readily apparent cause of this DFTM population decline, the collapse mimics other outbreaks where a naturally occurring nuclear polyhedrosis virus (NPV) appeared to have been the major larval mortality factor (Wickman et al. 1981). Abrupt increases and declines are common in tussock moth populations. Natural control factors such as disease, predators and parasites typically maintain DFTM populations at endemic levels. When outbreaks do occur they tend to be synchronized over large geographic areas, possibly influenced by large-scale weather patterns. Intervals between large outbreaks typically range from 9 to 11 years.

Figure 1. Change in condition of marked trees from 1999 to 2000.





1999



2000

This individual tree-monitoring project was initiated following concerns generated by Forest personnel regarding the survivability of the defoliated trees if the outbreak were to continue for additional years. Even though many of the marked trees had the reddish-brown appearance of a fading or dying tree, no mortality resulted and little reduction in growth is expected. This is a typical result when the outbreak lasts for only 1 year and defoliation is confined to the current year's foliage (Figure 1). Studies by Hansen (1995) and Wickman (1979, 1963) have shown that in order to cause defoliation-related mortality you need: (1) complete defoliation of more than 50 % of the total needle complement in one year, or (2) feeding damage over successive years intensive enough to destroy all new foliage.

Habitats types and conditions have been identified that are conducive to tussock moth outbreaks. In California, tussock moth outbreaks have occurred on ridge tops and upper slopes, on poorer sites, and in mixed conifer stands with a heavy re-growth of white fir related to fire exclusion and selective harvesting. All field going personnel are urged to continue to monitor for evidence of feeding and defoliation on white fir in this area and throughout other susceptible areas.

If you have any questions regarding this report, please call anyone on the Entomology staff at 530-257-2151.

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### References cited

- Dahlsten, D.L., Rowney, D.L., Copper, W.A., and J.M. Wenz. 1992. Comparison of artificial pupation shelters and other monitoring methods for endemic populations of Douglas-fir tussock moth, *Orgyia pseudotsugata* (Mcdunnough) (Lepidoptera: Lymantriidae). Can. Ent. 124: 359-369.
- Hansen, E.M. 1995. Douglas-fir tussock moth (*Orgyia pseudotsugata* Mcdunnough) on subalpine fir in northern Utah. Great Basin Naturalist 55(2) pp. 158-163.
- Smith, S.L. 2000. Douglas-fir tussock moth outbreak. Forest Health Protection Report No. NE00-04.
- Wickman, B.E. 1979. How to estimate defoliation and predict tree damage. U.S.D.A Agricultural Handbook 550.
- Wickman, B.E. 1963. Mortality and growth reduction of white fir following defoliation by the Douglas-fir tussock moth. U.S.D.A Research Paper PSW-7.
- Wickman, B.E., Mason, R.R. and G.C. Trostle. 1981. Douglas-Fir Tussock Moth. U.S.D.A., For. Ins. & Dis. Leaflet No. 86. 9 pp.

